Landing Statistics and Age Compositions for Pacific Cod (*Gadus macrocephalus*) from Queen Charlotte Sound, 1956-81

R. P. Foucher and S. J. Westrheim

Department of Fisheries and Oceans
Fisheries Research Branch
Pacific Biological Station
Nanaimo, British Columbia V9R 5K6

February 1983

Canadian Data Report of Fisheries and Aquatic Sciences No. 375

Canadian Data Report of Fisheries and Aquatic Sciences

These reports provide a medium for filing and archiving data compilations where little or no analysis is included. Such compilations commonly will have been prepared in support of other journal publications or reports. The subject matter of Data Reports reflects the broad interests and policies of the Department of Fisheries and Oceans, namely, fisheries management, technology and development, ocean sciences, and aquatic environments relevant to Canada.

Numbers 1-25 in this series were issued as Fisheries and Marine Service Data Records. Numbers 26-160 were issued as Department of Fisheries and the Environment, Fisheries and Marine Service Data Reports. The current series name was changed with report number 161.

Data Reports are not intended for general distribution and the contents must not be referred to in other publications without prior written clearance from the issuing establishment. The correct citation appears above the abstract of each report.

Rapport statistique canadien des sciences halieutiques et aquatiques

Ces rapports servent de base à la compilation des données de classement et d'archives pour lesquelles il y a peu ou point d'analyse. Cette compilation aura d'ordinaire été préparée pour appuyer d'autres publications ou rapports. Les sujets des Rapports statistiques reflètent la vaste gamme des intérêts et politiques du Ministère des Pêches et des Océans, notamment gestion des pêches, techniques et développement, sciences océaniques et environnements aquatiques, au Canada.

Les numéros 1 à 25 de cette série ont été publiés à titre de Records statistiques, Service des pêches et de la mer. Les numéros 26-160 ont été publiés à titre de Rapports statistiques du Service des pêches et de la mer, Ministère des Pêches et de l'Environnement. Le nom de la série a été modifié à partir du numéro 161.

Les Rapports statistiques ne sont pas préparés pour une vaste distribution et leur contenu ne doit pas être mentionné dans une publication sans autorisation écrite préalable de l'établissement auteur. Le titre exact paraît au haut du résumé de chaque rapport.

Canadian Data Report of

Fisheries and Aquatic Sciences No. 375

February 1983

LANDING STATISTICS AND AGE COMPOSITIONS FOR PACIFIC COD (*Gadus macrocephalus*) FROM QUEEN CHARLOTTE SOUND, 1956-81.

by

R. P. Foucher and S. J. Westrheim

Department of Fisheries and Oceans

Fisheries Research Branch

Pacific Biological Station

Nanaimo, B.C. V9R 5K6

(c) Minister of Supply and Services Canada 1983

Cat. No. Fs 97-13/375 ISSN 0706-6465

ABSTRACT

Foucher, R. P., and S. J. Westrheim. 1983. Landing statistics and age composition for Pacific cod (Gadus macrocephalus) from Queen Charlotte Sound, 1956-1981. Can. Data Rep. Fish. Aquat. Sci. 375: iii + 23 p.

Pacific cod landing statistics (Option-2 method) were compiled by International Area (5A and 5B) for each quarter-year for the period 1956-81. Corresponding age compositions (numbers landed) were calculated from length-frequency samples of landed cod using a computer method.

Key words: Landing statistics, age composition, Pacific cod, Queen Charlotte Sound.

RÉSUMÉ

Foucher, R. P., and S. J. Westrheim. 1983. Landing statistics and age composition for Pacific cod (Gadus macrocephalus) from Queen Charlotte Sound, 1956-1981. Can. Data Rep. Fish. Aquat. Sci. 375: iii + 23 p.

Des statistiques de débarquement de la morue du Pacifique (méthode de l'option 2) ont été compilées par zone internationale (5A et 5B) pour chaque trimestre au cours de la période allant de 1956 à 1981. Les compositions par âge correspondantes (quantités débarquées) ont été calculées à partir de données sur la fréquence des longueurs obtenues d'échantillons de morues débarqués en utilisant une méthode informatique.

Mots-clés: statistiques de débarquement, composition par âge, morue du Pacifique, détroit de la Reine-Charlotte.

INTRODUCTION

Pacific cod (Gadus macrocephalus) in British Columbia waters are noted for their short life span, substantial fluctuations in abundance of individual year-classes, and the concomitant fluctuations in trawl landings. A study is underway at the Pacific Biological Station (Nanaimo, B.C.) to determine if fishing is a factor in these fluctuations, and to develop a method for predicting the fluctuations in abundance.

The first step in this study is to assemble "data packages" consisting of time series of landing statistics and age compositions for each major region of cod abundance. "Data packages" have been assembled for Hecate Strait (Areas 5C and 5D) (Foucher and Jacobs 1981; Stocker 1981) and the southwest coast of Vancouver Island (Area 3C) (submitted for publication) (Fig. 1).

This report contains the third such "data package," for Queen Charlotte Sound (Areas 5A and 5B).

Compilation and analysis of landing statistics for the Canada-U.S. fishery in Queen Charlotte Sound are complicated by the heterogeneous fishery. By the early 1950s, the U.S. trawl fleet was actively exploiting all the major groundfish species, except arrowtooth flounder (Atheresthes stomias). Canadian participation in these fisheries developed more gradually. Using a minimum of 30% of the Canada-U.S. landings as the criterion for "active" participation, following are the "beginning" years for each species by the Canadian fleet: before 1950, rock sole (Lepidopsetta bilineata); 1956, Pacific cod; 1957, lingcod (Ophiodon elongatus); 1969, Pacific ocean perch (Sebastes alutus); and 1976, rockfishes (Sebastes sp.) other than Pacific ocean perch. Arrowtooth flounder are abundant and have been sought intermittently by both national fleets, but unsolved technological problems in preservation have precluded a sustained demand. All of the aforementioned species occupy part or all of the depth range of Pacific cod. Furthermore, a recent report (Westrheim and Tagart, In press) has shown that during 1963-78 U.S. vessels reported a deeper mean depth of capture of Pacific cod than that reported by Canadian vessels.

A further, but less important, complication was the Canadian and U.S. promulgations of 200-mile economic zones in 1977. United States vessels were gradually excluded from Canadian waters. Beginning April 1, 1979, U.S. vessels were restricted to targetting, under quota, only on rockfishes in Areas 3C, 3D, 5A, and 5B. All other areas were closed to them. Final exclusion of U.S. vessels occurred on April 1, 1981.

MATERIALS AND METHODS

LANDING STATISTICS

Materials

Canada-U.S. landings of trawl-caught groundfish, by species, month and international area, are published annually in the Groundfish Section of the PMFC[1] Data Series. This series began with the 1956 landings, and is continuing. Canadian total landings, by species, month, international area, and Canadian minor statistical area have been published in various Canadian data series. This series began with the 1945 landings (Thomson and Yates 1960, 1961), and is continuing. The latest, for 1981, is in Leaman (1982). Canadian interviewed landings, by species, are provided in considerable detail from computer tapes at the Pacific Biological Station (Nanaimo, B.C.). Details for each trawling trip relevant to this study include international area of catch; effort (h) expended; depth range (fath) trawled; weight of each species caught and retained for sale; and month of landing. Canadian interviewed landings were rarely less than 70% of Canadian total landings in any one year. Detailed records of U.S. landings are not available.

Methods

Landing statistics were compiled using the new Option-2 method, by international area (5A and 5B) by quarter-year for Queen Charlotte Sound. No segregation by locality (fishing ground) or minor statistical area was deemed advisable. One large bank dominated each international area--Cook Bank in Area 5A, and Goose Island Bank in Area 5B. Localities within these banks are not well defined.

A detailed description of the Option-2 method for allotting effort in a multi-species fishery has been submitted for publication. A brief description, in Stocker (1981, p. 69) is included here:

> Briefly described, the method involves arranging all-species effort and individual species' landings by depth interval in area-time cells. In each area-time cell, each species is allotted the all-species effort expended in the depth intervals containing the rank-1 (largest) and rank-2 (second-largest) landings of that species. For Pacific cod, and co-habitants, depth intervals were in 10-fm intervals, and area-time cells were fishing ground/quarter-year. LPUE (landing/h trawled) was calculated by dividing Option-2 landings by Option-2 effort. Estimated total effort ($\hat{E}$) is:

---

[1]Pacific Marine Fisheries Commission, Portland, Oregon, USA.

$$\hat{E} = \frac{L}{\ell} e,$$

where L = total landings,
ℓ = option-2 landings,
and e = option-2 effort.

Option-2 values for total all-species effort and total landings of individual species are calculated by multiplying the quotient of total landings ÷ total interviewed landings by the rank 1+2 interviewed effort (or landing). For Queen Charlotte Sound, the area-time cell was international area/quarter-year.

A modification of the Option-2 method was necessary for the data from Queen Charlotte Sound, because of the heterogeneous fishery described earlier. Thus "all-species" was replaced with "selected all-species," comprised of the three important shelf species--Pacific cod, lingcod, and rock sole.

AGE COMPOSITION

Materials

The length-frequency samples consisting of approximately 100-300 fish each were collected by port liaison officers from Canadian trawl landings. Although samples in later years sometimes included data by sex, the sexes were combined for consistency with earlier years. There is little evidence of an appreciable difference in mean length at age by sex for the important age classes. All cod were measured to the nearest centimeter of fork length.

Methods

Age compositions were derived using a computer program, modified for use with Pacific cod length-frequency data by Foucher and Fournier (1982) from the generalized method of Schnute and Fournier (1980).

Samples were grouped by month and international area (5A and 5B). The number of fish landed by quarter-year at each length from months sampled was computed by weighting the number of fish sampled at each length by the quotient of weight landed in months sampled over weight sampled and summing over the months sampled:

$$N_{ij} = \sum_{k=1}^{3} \frac{W_k}{w_k} n_{jk},$$

where N_{ij} = numbers in length interval j landed during quarter year i,
W_k = weight landed during month k,
w_k = weight sampled during month k,
and n_{jk} = number sampled in length interval j during month k.

The total number of fish landed in a quarter is calculated by summing the numbers landed over all lengths and weighting this sum by the ratio of weight landed in all months of the quarter-year to weight landed in only those months sampled (in many cases this ratio is equal to one):

$$N_i = \frac{W_i}{W_\ell} \sum_{j=1}^{J} N_{ij},$$

where N_i = numbers landed in quarter-year,
W_i = weight landed in quarter-year, all months,
and W_ℓ = weight landed in quarter year, only months sampled.

Quarterly length frequencies in numbers landed (N_{ij}) were each standardized to 1000 fish. The samples were aged by quarter-year rather than by month because of the lack of a significant difference in mean length at age by month within a quarter-year for other areas (unpublished data).

In some area/quarter-year units there were no samples available to estimate age composition. In each case, a careful examination was made of landings and age frequencies in adjoining quarters and years. Under certain conditions it appeared reasonable to use the age composition of the adjacent quarter-year as a substitute. These were (1) if landings from the quarter-year missing samples were small relative to the sum of Quarter II and III; (2) if landings in both quarter-years were concentrated towards the middle of the two-quarter period, i.e., June and July; and (3) if the pattern of age composition appeared to follow a regular pattern through adjacent years. The choice of a substitute was largely a matter of making a judgment based on these three factors. In some cases, no suitable substitute could be found and no estimate is given in the tables.

In some quarter-year samples, one or more large fish were omitted if their length was much beyond the range for the remainder of the sample. This was done to simplify the computer analysis. These fish were later included in the age composition by assigning them to the age group having the nearest mean length. These cases were indicated in Tables 8-11.

The numbers landed, by age, by quarter-year, were finally calculated:

$$N_{im} = N_i P_m,$$

where N_{im} = numbers landed in quarter-year i at age m,
and P_m = proportion of sample at age m.

The numbers landed by age for each whole year (Quarters I-IV) were calculated by adding the numbers landed from Quarters II-III. This sum was then extrapolated by the quotient of Quarter I-IV landings ÷ Quarter II-III landings.

RESULTS

LANDING STATISTICS

The trawl fishery for Pacific cod in Queen Charlotte Sound occurs primarily during spring and summer (Fig. 2). In Area 5A, 78% of the 1956-81 cumulative annual landings were made during April-September, and for Area 5B, 89% (Table 1). This seasonal disparity is due to the severe sea conditions during autumn and winter. Goose Island Bank (Area 5B) is more exposed, and farther from shelter, and hence exhibits a greater seasonal disparity than Cook Bank (Area 5A).

Therefore landing statistics for April-September have been selected to be representative of the Pacific cod stock in Queen Charlotte Sound, for this analysis.

Use of Pacific cod, lingcod, and rock sole together as "selected all-species" is justified by the fact that these three species accounted for 47-93% of the cumulative 1956-81 all-species landings from Areas 5A and 5B which were caught in less than 100 fath during April-June and July-September (Table 2). Secondary species were rockfish (Scorpaenidae), mostly exploited by U.S. vessels.

Landing statistics, by quarter-year, for Pacific cod from Areas 5A and 5B, respectively, for April-September, 1956-81 are contained in Tables 3 and 4, and for January-December 1956-81, in Tables 5 and 6.

Compilation of Pacific cod landing statistics for Queen Charlotte Sound as a whole (Areas 5A and 5B) is in abeyance, pending results of stock delineation studies.

AGE COMPOSITION

A total of 78,411 Pacific cod were measured--48,253 from 5A and 32,158 from 5B (Table 7). Age compositions for Quarters I and IV were not calculated, due to the small number of fish sampled and the complete lack of samples for many years. Also, only a small proportion of the landings were made in these quarter-years (Table 1).

For Area 5A, age compositions of Pacific cod, in numbers landed, for Quarters II, III, and I-IV, during 1956-81, are contained in Tables 8, 9, and 10, respectively. For Area 5B, comparable data are contained in Tables 11, 12, and 13. Details on missing data are noted in footnotes to the above tables.

ACKNOWLEDGMENTS

The authors wish to express their thanks to Wayne Harling, Glenn Seaton and Mark Yamanaka, all of whom assisted with compilation of statistics and/or determination of age compositions.

LITERATURE CITED

Foucher, R. P., and D. Fournier. 1982. Derivation of Pacific cod age compositions using length-frequency analysis. North American Journal of Fisheries Management 2: 276-284.

Foucher, R. P. and K. F. Jacobs. 1981. Pacific cod age composition and landing statistics for selected fishing grounds, and quarter years, in Hecate Strait, 1958-80. Can. Data Rep. Fish. Aquat. Sci. 301: 11 p.

Leaman, J. E. 1982. Catch and effort statistics of the Canadian groundfish fishery on the Pacific coast in 1981. Can. Tech. Rep. Fish. Aquat. Sci. 1124: 90 p.

Schnute, J., and D. Fournier. 1980. A new approach to length-frequency analysis: growth structure. Can. J. Fish. Aquat. Sci. 37(9): 1337-1351.

Stocker, M., Editor. 1981. Groundfish stock assessments off the west coast of Canada in 1981 and recommended total allowable catches for 1982. Can. MS Rep. Fish. Aquat. Sci. 1626: 282 p.

Thomson, J. A., and A. N. Yates. 1960. British Columbia landings of trawl-caught groundfish by month, by major statistical area, Vol. 1, 1945-49. Fish. Res. Board Can. Circ. Ser. No. CNS 1: 86 p.

Thomson, J. A., and A. N. Yates. 1961. British Columbia landings of trawl-caught groundfish by month by minor statistical area. Vol. 4, 1945-47. Fish. Res. Board Can. Circ. (Stat. Ser.) No. 4: 44 p.

Westrheim, S. J. and R. P. Foucher (Submitted for publication). Canada-U.S. landing statistics and age composition for Pacific cod (Gadus macrocephalus) from trawling grounds off the southwest coast of Vancouver Island, 1956-81. Can. Data Rep. Fish. Aquat. Sci.

Westrheim, S. J. and J. V. Tagart. (In press). Bathymetric distribution of Pacific cod (Gadus macrocephalus) off British Columbia and Washington State. Int. North Pacific Fish. Comm. Bull.

Table 1. Canada-U.S. cumulative landings (t) of Pacific cod from Queen Charlotte Sound, by major area and quarter-year, 1956-81.

Quarter-year	Area 5A (t)	%	Area 5B (t)	%	Total (t)	%
Jan-Mar	1,162	7	611	3	1,773	5
Apr-Jun	8,088	45	9,233	49	17,321	47
Jul-Sep	5,964	33	7,464	40	13,428	37
Oct-Dec	2,634	15	1,392	7	4,026	11
Total	17,848	100	18,700	99	36,548	100

Table 2. Cumulative Canadian interviewed all-species landings (t) from Queen Charlotte Sound, by major area and category, April-June and July-September, 1956-81.

Quarter-year	Category[a]	Area 5A (t)	%	Area 5B (t)	%
Apr-Jun	T	14,610		22,007	
	<100	13,621	100	12,918	100
	Sel. spp.	9,567	93	7,475	58
Jul-Sep	T	15,183		25,799	
	<100	14,041	100	17,447	100
	Sel. spp.	6,557	47	10,195	68

[a]T = All species, all depths.

<100 = All species, <100 fm.

Sel. spp. = Pacific cod + lingcod + rock sole <100 fm.

Table 3. Canada-U.S. landing statistics (Option-2) for Pacific cod from Area 5A, April-June and July-September, 1956-81.

Year	April-June					July-September				
	Landings (t)		Effort (h)		LPUE[a]	Landings (t)		Effort (h)		LPUE[a]
	Total	Opt-2	Opt-2	Total	(kg/h)	Total	Opt-2	Opt-2	Total	(kg/h)
1956	320	196	1,561	2,549	126	376	361	799	832	452
1957	833	599	629	875	952	787	663	1,383	1,642	479
1958	334	258	2,590	3,353	100	181	167	1,119	1,213	149
1959	347	291	1,250	1,492	233	157	107	547	803	196
1960	138	122	1,466	1,658	83	60	59	1,090	1,108	54
1961	64	59	975	1,058	61	10	8	598	748	13
1962	46	39	1,005	1,185	39	79	72	1,172	1,286	61
1963	67	60	859	959	70	183	163	859	964	190
1964	210	172	1,072	1,309	160	148	128	626	724	205
1965	276	235	735	884	312	208	175	732	870	239
1966	347	341	865	880	394	393	375	1,884	1,974	199
1967	237	226	932	977	243	245	202	774	939	261
1968	370	280	1,666	2,202	168	168	124	1,105	1,497	112
1969	157	137	2,555	2,928	54	119	85	971	1,359	88
1970	78	60	997	1,296	60	56	44	536	682	82
1971	211	163	1,065	1,379	153	181	106	718	1,226	148
1972	423	325	671	873	484	230	158	585	852	270
1973	333	210	765	1,213	275	154	143	543	585	263
1974	458	278	1,043	1,718	267	299	247	492	596	502
1975	417	328	762	969	430	203	202	461	463	438
1976	425	381	1,408	1,571	271	611	558	1,991	2,180	280
1977	406	300	1,355	1,834	221	261	246	1,202	1,275	205
1978	594	348	978	1,669	356	289	206	720	1,010	286
1979	464	253	540	990	469	344	240	767	1,099	313
1980	314	204	815	1,254	250	188	77	254	620	303
1981	219	130	588	991	221	34	27	245	309	110

[a]Opt-2 landings ÷ Opt-2 effort.

Table 4. Canada-U.S. landing statistics (Option-2) for Pacific cod from Area 5B, April-June and July-September, 1956-81.

Year	April-June					July-September				
	Landings (t)		Effort (h)		LPUE[a]	Landings (t)		Effort (h)		LPUE[a]
	Total	Opt-2	Opt-2	Total	(kg/h)	Total	Opt-2	Opt-2	Total	(kg/h)
1956	187	169	592	655	285	257	257	1,017	1,017	253
1957	230	213	486	525	438	64	58	554	611	105
1958	338	302	1,058	1,214	278	108	108	864	864	125
1959	249	212	1,046	1,229	203	82	81	863	874	94
1960	159	122	862	1,123	142	177	152	1,412	1,644	108
1961	114	110	1,303	1,350	84	13	12	913	989	13
1962	109	100	1,156	1,260	87	123	119	1,450	1,499	82
1963	227	224	2,102	2,130	107	153	151	1,406	1,425	107
1964	294	291	1,334	1,348	218	376	364	1,102	1,138	330
1965	751	722	1,261	1,312	573	368	355	1,366	1,416	260
1966	437	426	1,432	1,469	297	254	222	2,106	2,410	105
1967	480	471	1,817	1,852	259	250	215	2,000	2,326	108
1968	187	165	2,057	2,331	80	117	117	1,607	1,607	73
1969	127	123	1,506	1,555	82	140	139	2,275	2,291	61
1970	57	37	1,042	1,605	36	44	29	902	1,369	32
1971	239	179	1,474	1,968	121	204	193	2,120	2,241	44
1972	857	693	3,553	4,394	195	605	390	1,329	2,062	293
1973	829	781	2,890	3,068	270	416	353	1,938	2,284	182
1974	859	709	3,447	4,176	206	501	383	1,834	2,399	209
1975	652	567	2,262	2,601	251	878	782	2,417	2,714	324
1976	268	261	1,146	1,177	228	635	584	2,249	2,445	260
1977	232	209	1,186	1,317	176	255	204	1,589	1,986	128
1978	197	142	676	938	210	686	609	1,829	2,060	333
1979	459	325	906	1,280	359	385	313	1,717	2,112	182
1980	314	263	1,101	1,315	239	303	246	1,203	1,482	204
1981	381	314	896	1,087	350	70	52	1,129	1,520	46

[a]Opt-2 landings ÷ Opt-2 effort.

Table 5. Canada-U.S. landings statistics (Option-2) for Pacific cod from Area 5A, January-December, 1956-81.

Year	Equivalent effort[a] (h)	Landings (t)		LPUE[b] (kg/h)
		Can-U.S. Total	Canada interv.[b]	
1956	4,911	1,159	178	236
1957	3,581	2,245	681	627
1958	5,922	681	92	115
1959	2,710	599	306	221
1960	3,268	232	113	71
1961	2,279	98	55	43
1962	3,412	174	59	51
1963	2,208	287	33	130
1964	2,898	513	250	177
1965	2,888	797	208	276
1966	4,100	1,066	368	260
1967	3,032	761	210	251
1968	4,288	626	305	146
1969	6,175	389	152	63
1970	2,721	185	66	68
1971	3,053	461	147	151
1972	1,964	756	309	385
1973	2,307	623	213	270
1974	2,538	868	322	342
1975	1,644	712	384	433
1976	4,138	1,142	738	276
1977	3,276	701	471	214
1978	2,991	975	711	326
1979	2,446	922	773	377
1980	2,255	593	481	263
1981	1,505	283	220	188

[a]Jan-Dec landings ÷ Apr-Sep LPUE.

[b]Apr-Sep

Table 6. Canada-U.S. landing statistics (Option-2) for Pacific cod from Area 5B, January-December, 1956-81.

Year	Equivalent effort[a] (h)	Landings (t)		LPUE[b] (kg/h)
		Can-U.S. Total	Canada interv.[b]	
1956	2,242	594	90	265
1957	1,912	499	163	261
1958	2,367	497	318	210
1959	2,268	347	292	153
1960	3,217	386	248	120
1961	2,582	142	98	55
1962	2,952	248	178	84
1963	3,645	390	116	107
1964	2,833	762	204	269
1965	2,788	1,143	377	410
1966	4,071	745	194	183
1967	4,111	740	84	180
1968	4,338	334	76	77
1969	4,493	310	75	69
1970	3,353	114	5	34
1971	4,490	467	57	104
1972	7,045	1,564	336	222
1973	5,494	1,291	203	235
1974	6,879	1,424	284	207
1975	6,080	1,751	737	288
1976	4,534	1,129	703	249
1977	3,805	567	375	149
1978	3,283	985	855	300
1979	3,700	899	756	243
1980	3,624	801	612	221
1981	3,155	571	425	181

[a]Jan-Dec landings ÷ Apr-Sep LPUE.

[b]Apr-Sep

Table 7. Numbers of Pacific cod sampled, by quarter-year, by area, for Queen Charlotte Sound, 1956-81.

Area	Quarter	Numbers sampled
5A	Jan-Mar	1,284
	Apr-Jun	30,341
	Jul-Sep	14,134
	Oct-Dec	2,494
Total		48,253
5B	Jan-Mar	564
	Apr-Jun	16,387
	Jul-Sep	13,087
	Oct-Dec	120
Total		30,158
Grand total		78,411

Table 8. Canada-U.S. Pacific cod landings(t), effort(h), and age frequency (nos. landed) during April-June from Area 5A, 1956-81.

Year	C-US Land (t)	C-US Eff (h)	Age 1	2	3	4	5	6	7	8	9	10
1956	320	2546	-	122965	46561	9168	539	539	-	-	-	-
1957	833	875	-	186194	131744	44549	12565	4188	381	1142	-	-
1958	334	3353	-	2571	64410	38083	13470	2327	1469	245	-	-
1959	347	1492	-	27254	86088	25235	5335	288	-	-	-	-
1960	138	1658	-	6935	15049	9474	8431	4351	317	499	272	-
1961	64	1058	534	5391	10809	5712	2536	988	507	214	-	-
1962	46	1185	-	3326	4440	4372	2177	2143	634	-	51[a]	-
1963	67	959	-	7549	5411	8760	2834	1031	52	103[a]	-	-
1964	210	1309	-	54040	29550	10322	5060	1316	810	101[a]	-	-
1965	276	884	-	12872	48489	24583	6485	2904	1161	290	-	-
1966	347	880	-	63549	35275	10502	14676	6732	2289	1212	269	135
1967	237	977	-	27246	35754	17018	3266	1977	344	344	-	-
1968	370	2202	-	43638	35341	42409	25353	5224	768	922	-	-
1969	157	2928	-	14729	18981	13250	6039	3636	2712	1602	616	62[a]
1970	78	1296	-	23117	11028	1516	1781	114	341	-	-	-
1971	211	1379	-	60865	21675	8999	4064	968	194	-	-	-
1972	423	873	-	84697	76066	38134	1204	602	-	-	-	-
1973	333	1213	-	40640	49010	22200	7764	243	1456	-	-	-
1974[b]	458	1718	-	53494	61088	31370	14694	1816	1651	991	-	-
1975	417	969	-	-	-	-	-	-	-	-	-	-
1976	425	1571	-	125920	81660	3762	6639	1328	1549	443	-	-
1977	406	1834	-	150661	60835	19486	4753	1426	475	-	-	-
1978	594	1669	2150	128628	164457	45145	13615	4300	-	-	-	-
1979	464	990	-	199105	31775	19219	3331	2819	-	-	-	-
1980	314	1254	-	100665	46546	31031	3879	1662	1108	-	-	-
1981	219	991	-	100419	18324	1808	-	-	-	-	-	-

[a] Fish omitted during computer analysis.
[b] No samples available to estimate age composition.

Table 9. Canada-U.S. Pacific cod landings(t), effort(h), and age frequency (nos. landed) during July-September, from Area 5A, 1956-81.

Year	C-US Land (t)	C-US Eff (h)	Age 1	2	3	4	5	6	7	8	9
1956	376	452	-	117768	17553	20745	-	3511	-[a]	-	-
1957[b]	787	479	6493	257211	58801	31746	5411	721	361	-	-
1958[b]	181	149	-	1394	34905	20638	7299	1261	796	133	-
1959	157	196	1440	27484	21411	9516	2254	438	63[a]	-	-
1960[b]	60	54	-	1296	14711	9397	5217	1523	130	130	-
1961[b]	10	13	83	842	1689	892	396	154	79	33	-
1962	79	61	-	23599	6917	4476	1701	-	296	-	-
1963[c]	183	190	-	-	-	-	-	-	-	-	-
1964	148	205	-	53534	26413	11840	6477	1417	1518	-	-
1965	208	239	-	52457	17421	21389	4549	774	-	194	-
1966	393	199	-	79302	40661	12117	942	1346	269	-	-
1967	245	261	-	38591	28105	13580	4040	1375	-	-	258
1968	168	112	-	65303	37799	36109	10602	2766	768	-	307
1969	119	88	-	22432	23850	11709	2342	801	493	-	-
1970	56	82	-	19365	16485	1743	152	-	-	152[a]	-
1971[b]	181	148	-	85540	9193	1355	387	290	-	-	-
1972[b]	230	270	-	84697	76066	38134	1204	602	-	-	-
1973	154	263	1698	44158	59079	14194	243	1941	-	-	-
1974	299	502	-	125479	23280	14694	660	991	-	-	-
1975[c]	203	438	-	-	-	-	-	-	-	-	-
1976	611	280	-	127469	79890	12614	1328	-	-	-	-
1977	261	205	-	177038	49903	6891	3327	475	-	-	-
1978	289	286	-	96023	152634	88141	16482	2866	2150	-	-
1979	344	313	7944	120950	88406	38950	-	-	-	-	-
1980[b]	188	303	-	100665	46546	31031	3879	1662	1108	-	-
1981[b]	34	110	-	100419	18324	1808	-	-	-	-	-

[a] Fish omitted during computer analysis.
[b] No Quarter III samples available, substituted Quarter II age composition.
[c] No samples available to estimate age composition.

Table 10. Canada-U.S. Pacific cod landings(t), effort(h) and age frequency (nos. landed) during January-December from Area 5A, 1956-81.

Year	C-US Land (t)	C-US Eff (h) [a]	Age 1	2	3	4	5	6	7	8	9	10
1956	1159	4911	-	400876	106765	49812	898	6744	-	-	-	-
1957	2245	3581	8998	614472	264058	105730	24911	6803	1028	1583	-	-
1958	681	5922	-	5243	131327	77649	27463	4745	2995	500	-	-
1959	599	2710	1711	65056	127762	41301	9019	863	75	-	-	-
1960	232	3268	-	9644	34870	22111	15992	6883	524	737	319	-
1961	98	2279	817	8255	16551	8746	3883	1512	776	327	-	-
1962 [b]	174	3412	-	37480	15809	12316	5398	2983	1295	-	71	-
1963	287	2208	-	-	-	-	-	-	-	-	-	
1964	513	2898	-	154149	80193	31757	16532	3916	3336	145	-	-
1965	797	2888	-	107577	108534	75702	18170	6057	1912	797	-	-
1966	1066	4100	-	205783	109389	32584	22498	11637	3685	1746	388	194
1967	761	3032	-	103946	100823	48309	11535	5292	543	543	407	-
1968	626	4288	-	126760	85103	91361	41836	9297	1787	1073	357	-
1969	389	6175	-	52375	60367	35178	11812	6254	4517	2258	868	87
1970	185	2721	-	58651	37984	4499	2669	157	471	210	-	-
1971	461	3035	-	172175	36301	12177	5234	1479	228	-	-	-
1972	756	1964	-	196113	176128	88298	2788	1394	-	-	-	-
1973	623	2307	2172	108479	138274	46557	10243	2794	1863	-	-	-
1974	868	2538	-	205216	96739	52818	17605	3219	1893	1136	-	-
1975 [c]	712	1644	-	-	-	-	-	-	-	-	-	-
1976	1142	4138	-	279315	178079	18052	8782	1464	1707	488	-	-
1977	701	3276	-	344403	116383	27722	8492	1998	499	-	-	-
1978	975	2991	2374	248057	350129	147173	33233	7913	2374	-	-	-
1979	922	2446	9065	365211	137137	66376	3801	3217	-	-	-	-
1980	593	2255	-	237826	109967	73312	9164	3927	2618	-	-	-
1981	283	1505	-	224653	40994	4045	-	-	-	-	-	-

[a] Equivalent effort - see Table 5.
[b] Nos. landed not calculated due to lack of an estimate for Quarter III.
[c] No samples available to estimate age composition.

Table 11. Canada-U.S. Pacific cod landings(t), effort(h), and age frequency (nos. landed) during April-June from Area 5B, 1956-81.

Year	C-US Land (t)	C-US Eff (h)	Age 1	2	3	4	5	6	7	8	9	10	11
1956	187	285	-	48490	13450	1448	138	4483	-	-	966	-	-
1957	230	438	-	61359	27533	7473	1377	492	-	-	-	98	-
1958	338	278	-	30159	62582	20980	3815	1430	-	119	119	-	-
1959	249	203	-	2183	46185	23596	7726	3443	840	-	-	-	-
1960	159	142	-	1737	23126	18908	3821	893	645	248	248	-	-
1961	114	84	-	629	2974	6978	10267	6549	572	229	200	200	-
1962	109	87	-	4322	897	1464	2196	5597	5007	3117	756	118	142
1963	227	107	-	34160	28047	24451	1438	719	539	180	360	-	-
1964	294	218	-	91660	30148	6760	4732	1893	-	-	-	-	-
1965	751	573	-	60195	113868	62201	1756	6772	4264	1756	-	-	-
1966	437	297	-	42050	29785	24260	28168	7952	1483	539	270	270	-
1967	480	259	-	-	36498	47661	15929	14549	6647	2759	1380	-	-
1968	187	80	-	32090	6686	13505	10028	2942	401	1203	-	-	-
1969	127	82	-	1751	5961	6356	5198	904	4774	2429	169	565	141
1970[a]	57	36	-	-	-	-	-	-	-	-	-	-	-
1971[b]	239	121	-	16682	1502	4935	4613	10352	7509	5739	1180	590	536
1972	857	195	-	155276	54618	1716	5719	28596	1716	26594	4861	2288	4575
1973	829	270	-	17104	64492	155342	28321	3365	8692	-	-	3084	-
1974[b]	859	206	-	85557	102785	39128	41756	19272	876	2628	-	-	-
1975	652	251	-	187161	122683	32413	3137	-	2091	1046	-	-	-
1976	268	228	-	50854	61153	12488	2446	-	901	-	901	-	-
1977	232	176	-	88825	31130	8855	6503	1660	830	553	-	-	-
1978	197	210	878	16340	61143	7379	176	351	439	703	-	439	-
1979	459	359	8383	39024	18356	32809	23848	19512	2602	-	-	-	-
1980	314	239	11838	43838	58277	12228	780	2081	520	-	-	520[c]	-
1981[a]	381	350	-	-	-	-	-	-	-	-	-	-	-

[a] No samples available to estimate age composition.
[b] No Quarter II samples available, substituted Quarter III age composition.
[c] Fish omitted during computer analysis.

Table 12. Canada-U.S. Pacific cod landings(t), effort(h), and age frequency (nos. landed) during July-September from Area 5B, 1956-81.

Year	C-US Land (t)	C-US Eff (h)	Age 1	2	3	4	5	6	7	8	9	10	11
1956[a]	257	253	-	66642	18485	1991	190	6162	-	-	1327	-	-
1957	64	105	-	15440	6539	1217	95	310	95	-	167	-	-
1958	108	125	3215	24685	6823	1000	-	-	-	-	-	-	-
1959	82	94	-	270	12937	7954	2185	172	933	98[b]	-	-	-
1960	177	108	-	389	4842	16644	12364	5447	1340	1427	778	-	-
1961	13	13	-	154	470	864	1030	473	144	64	-	-	-
1962	123	82	236	15999	2970	2970	1046	6211	1350	2531	203	236	-
1963	153	107	-	22476	14429	16260	1387	277	444	222	-	-	-
1964	376	330	-	6545	65679	18699	14842	8648	2454	-	-	-	-
1965	368	260	-	1551	21981	37942	23531	4195	1551	456	-	-	-
1966	254	105	-	18747	14264	19911	3493	1106	466	233	-	-	-
1967	250	108	-	4137	30666	12477	12280	788	4728	328	-	263	-
1968	117	73	-	22064	6900	9090	2272	289	578	-	124	-	-
1969	140	61	1023	7394	11951	21437	1070	2465	1163	-	-	-	-
1970[c]	44	32	-	-	-	-	-	-	-	-	-	-	-
1971	204	44	-	14239	1282	4212	3937	8836	6410	4899	1007	504	458
1972	605	293	-	257177	31813	6244	1784	-	-	-	-	-	-
1973[a]	416	182	-	8583	32363	77952	14212	1688	4362	-	-	-	-
1974	501	209	-	49900	59948	22821	24354	11240	511	1533	-	-	-
1975	878	324	-	184492	95662	46393	25174	1079	4675	719	1439	-	-
1976	635	260	-	30544	92052	39601	21486	14956	3160	7162	1053	632	-
1977	255	128	-	55958	31806	11213	3235	2695	1725	647	539	-	-
1978	686	333	1678	23728	132778	64951	7909	5273	2397	-	-	959	-
1979	385	182	1500	94801	31500	15300	6900	-	-	-	-	-	-
1980	1303	204	3178	57225	25501	26111	-	-	-	-	-	-	-
1981	70	46	-	15373	11729	1715	1562	245	-	-	-	-	-

[a] No Quarter III samples available, substituted Quarter II age composition.
[b] Fish omitted during computer analysis.
[c] No samples available to estimate age composition.

Table 13. Canada-U.S. Pacific cod landings(t), effort(h), and age frequency (nos. landed) during January-December from Area 5B, 1956-81.

Year	C-US Land (t)	C-US Eff[a] (h)	Age 1	2	3	4	5	6	7	8	9	10	11
1956	594	2242	-	154028	42724	4601	439	14241	-	-	3068	-	-
1957	499	1912	-	130349	57830	14749	2498	1361	161	-	283	166	-
1958	497	2367	3583	61115	77341	24493	4251	1594	-	133	133	-	-
1959	347	2268	-	2572	61980	33075	10390	3790	1859	103	-	-	-
1960	386	3217	-	2442	32130	40842	18593	7283	2280	1924	1179	-	-
1961	142	2582	-	875	3851	8768	12631	7851	801	328	224	224	-
1962	248	2952	252	21722	4134	4740	3466	12622	6795	6038	1025	378	152
1963	390	3645	-	58126	43594	41782	2899	1022	1009	413	369	-	-
1964	762	2833	-	111690	108985	28955	22262	11988	2791	-	-	-	-
1965	1143	2788	-	63070	138763	102291	25829	11202	5940	2259	-	-	-
1966	745	4071	-	65548	47491	47623	34135	9766	2101	832	291	291	-
1967	740	4111	-	4194	68084	60962	28595	15547	11531	3129	1399	267	-
1968	334	4338	-	59498	14927	24825	13514	3550	1076	1322	136	-	-
1969	310	4493	1188	10618	20797	32269	7277	3912	6893	2820	196	656	164
1970[b]	114	3353	-	-	-	-	-	-	-	-	-	-	-
1971	467	4490	-	32596	2935	9643	9013	20228	14673	11214	2305	1153	1048
1972	1564	7045	-	441229	92461	8515	8026	30591	1836	28449	5200	2448	4894
1973	1291	5494	-	26636	100434	241914	44105	5240	13536	-	-	3198	-
1974	1424	6879	-	141831	170391	64864	69221	31948	1452	4357	-	-	-
1975	1751	6080	-	425336	249884	90189	32400	1235	7743	2020	1647	-	-
1976	1129	4534	-	101770	191549	65126	29922	18699	5077	8954	2443	790	-
1977	567	3805	-	168567	73275	23365	11338	5070	2975	1397	628	-	-
1978	985	3283	2851	44696	216322	80685	9019	6274	3164	784	-	1559	-
1979	899	3700	10527	142546	53105	51244	32752	20784	2772	-	-	-	-
1980	801	3624	7438	50063	41500	18992	386	1031	258	-	-	258	-
1981[c]	571	3155	-	-	-	-	-	-	-	-	-	-	-

[a]Equivalent effort - see Table 6.
[b]No samples available to estimate age composition.
[c]Nos. landed not calculated due to lack of an estimate for Quarter II.

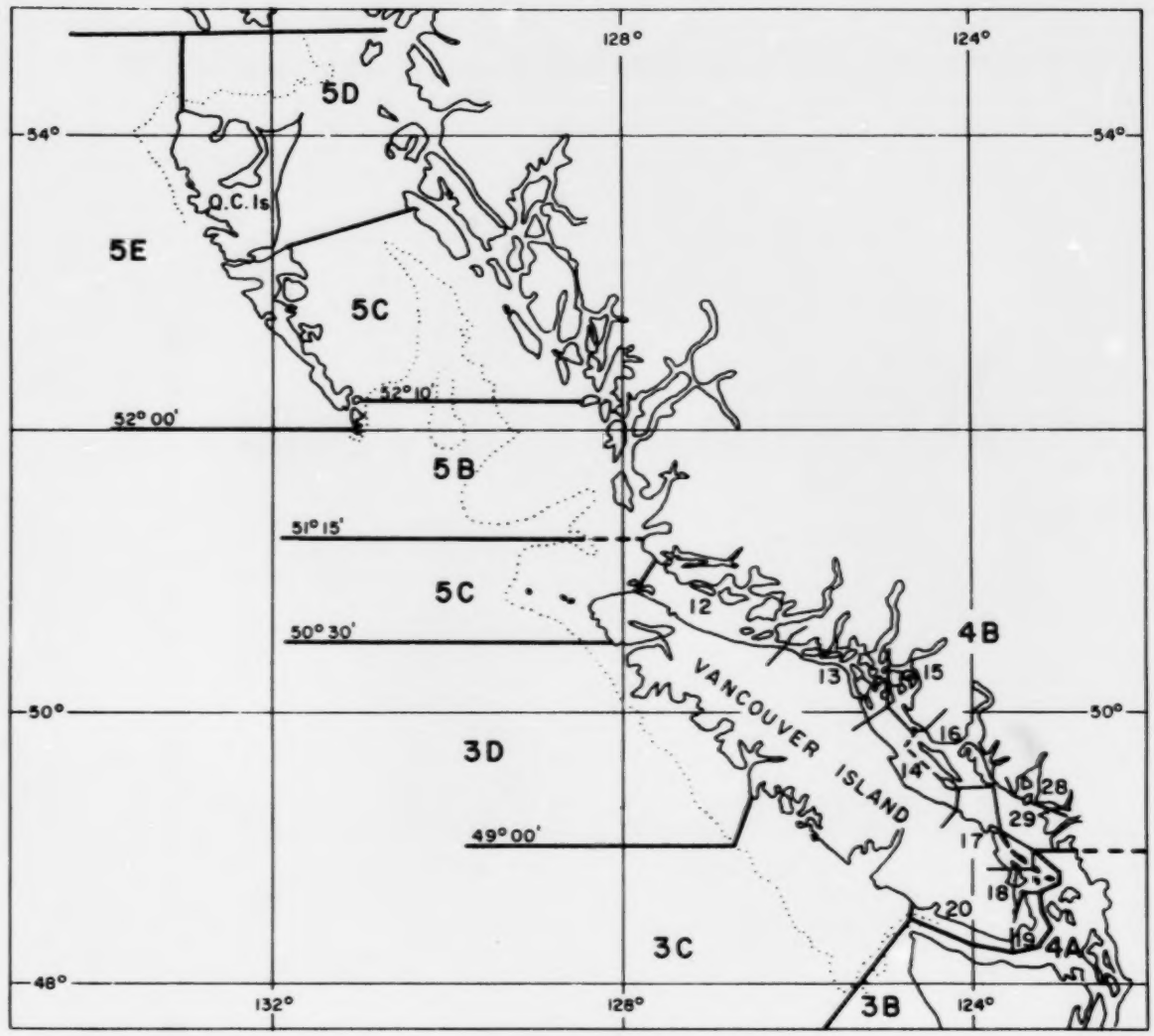

Fig. 1. International (Pacific Marine Fisheries Commission) Statistical Areas along the British Columbia coast.

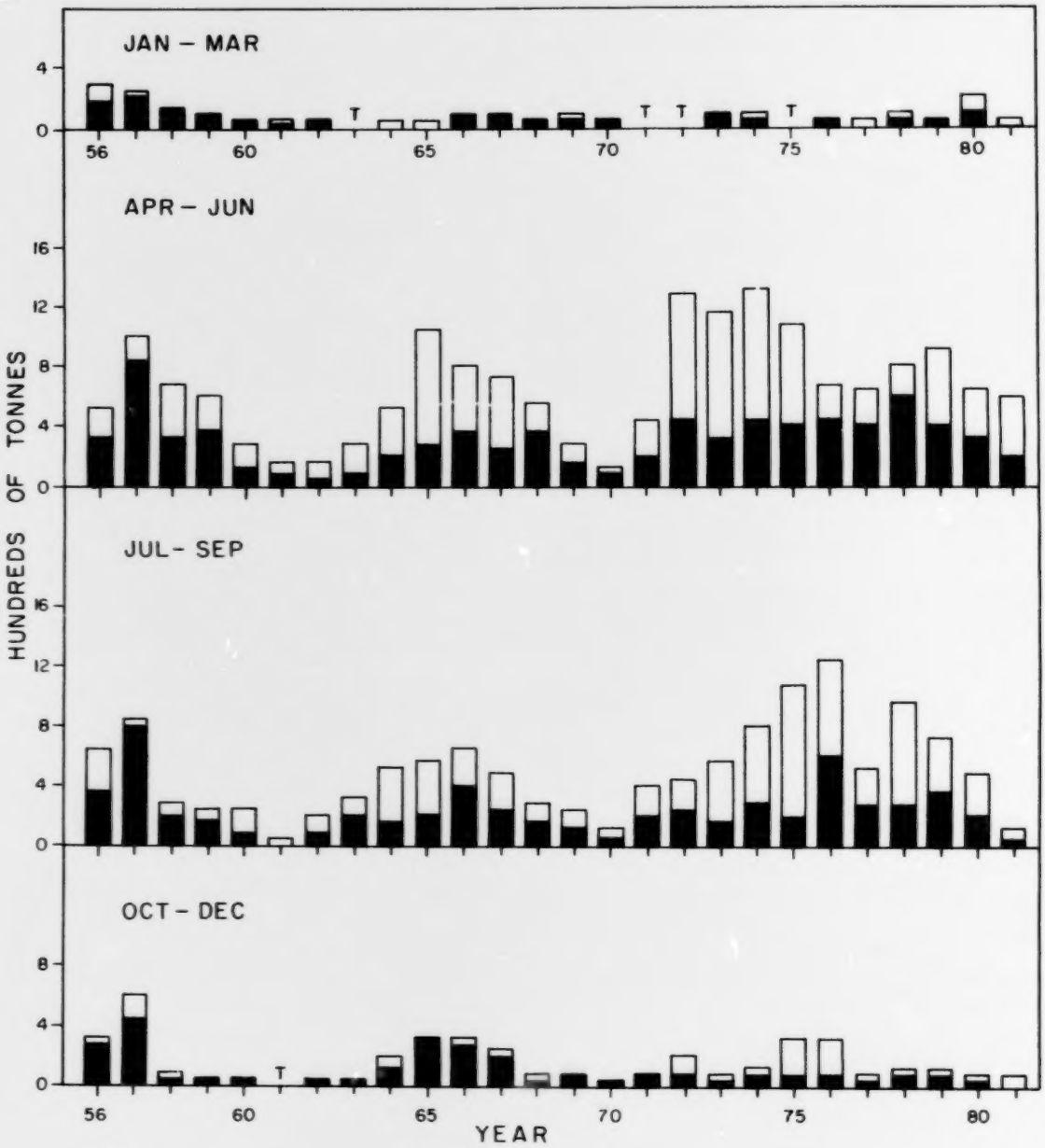

Fig. 2. Canada-U.S. landings (t) of Pacific cod from Queen Charlotte Sound (Areas 5A and 5B), by quarter-year, 1956-81. (Shaded area = landings from Area 5A.)